

Revised: 10/29/03 Laboratory: \_\_\_\_\_ Inspector(s): \_\_\_\_\_ Date: \_\_\_\_\_

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LOADBEARING CONCRETE MASONRY UNITS  
ASTM C 90-03

## 4. Materials:

4.1. Cementitious Materials – Shall conform to following applicable specifications:

4.1.1. Portland cement – Specification C 150 \_\_\_\_\_

4.1.2. Modified Portland cement conforming to Specification C 150, modified as follows:

4.1.2.1. Limestone – Calcium carbonate, w/ min 85 % CaCO<sub>3</sub> content can be added provided these requirements of C150 as modified are met:

(1) Limitation on insoluble residue – 1.5 % \_\_\_\_\_

(2) Limitation on air content of mortar – Volume %, 22 % max \_\_\_\_\_

(3) Limitation on loss on ignition – 7 % \_\_\_\_\_

4.1.3. Blended hydraulic cements – Specification C 595 \_\_\_\_\_

4.1.4. Hydraulic cement – Specification – Specification C 1157 \_\_\_\_\_

4.1.5. Pozzolans – Specification C 618 \_\_\_\_\_

4.1.6. Blast furnace slag cement – Specification C 989 ---

4.2. Aggregates – conform to following specifications, except grading requirements not necessarily apply:

4.2.1. Normal weight aggregates – Specification C 33 \_\_\_\_\_

4.2.2. Lightweight aggregates – Specification C 331 \_\_\_\_\_

4.3. Other constituents – Air-entraining agents, coloring pigments, integral water repellents, finely ground silica, &amp; other constituents established as suitable &amp; conform to ASTM stds \_\_\_\_\_

## 5. Physical Requirements:

5.1. On delivery, units conform to Tables 1 &amp; 2 \_\_\_\_\_

5.2. On delivery, linear shrinkage of units shall not exceed 0.065 % \_\_\_\_\_

5.3. Hollow units:

5.3.1. Face shell thickness &amp; web thickness conform to Table 1 \_\_\_\_\_

5.4. Solid units:

5.4.1. Net cross-sectional area of solid units parallel to bearing surface, not &lt; 75 % of gross cross-sectional area in same plane \_\_\_\_\_

5.5. End flanges:

5.5.1. The thickness of ea. flange not &lt; minimum face shell thickness \_\_\_\_\_

## 6. Permissible Variations in Dimensions:

6.1. Standard units – Width, height, & length not differ >  $\pm 1/8$ -in. from spec. dim \_\_\_\_\_

6.2. Particular feature units in accordance w/ following:

6.2.1. Molded face units width, height, & length not differ >  $\pm 1/8$ -in. from spec. dim \_\_\_\_\_Dimensions of molded features w/in  $\pm 1/16$ -in. of spec. std dim & w/in  $\pm 1/16$ -in. of spec. placement of molded feature \_\_\_\_\_6.2.2. Split-faced units, all non-split overall dim not differ >  $\pm 1/8$ -in. from spec. std dim \_\_\_\_\_6.2.3. Slump units, no overall ht dim differ >  $\pm 1/8$ -in. from spec. std dim \_\_\_\_\_

## 7. Finish and Appearance:

7.1. All units shall be sound &amp; free of cracks or other defects that interfere w/ placement \_\_\_\_\_

7.2. No chips or cracks on units when used in exposed wall \_\_\_\_\_

7.3. Color &amp; texture spec. by purchaser \_\_\_\_\_

7.4. Shipment not to contain &gt; 5 % broken units \_\_\_\_\_

## 8. Sampling and Testing:

8.1. Purchaser or authorized representative accorded proper facilities to inspect &amp; spl units at mfr \_\_\_\_\_

8.2. Sample &amp; test units in accordance w/ C 140 \_\_\_\_\_

8.3. Total linear drying shrinkage based on units made w/ same materials, concrete mix design, manufacturing process, &amp; curing methods in accordance w/ C 426 \_\_\_\_\_

## 9. Compliance \_\_\_\_\_

Data Sheet \_\_\_\_\_

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MASONRY CEMENT  
ASTM C 91-03

## 4. Classification:

- 4.1. Type N – Spec. C 270 w/o addition of cements or hydrated lime; Type S or M if cement added \_\_\_\_
- 4.2. Type S – Spec. C 270 w/o addition of cements or hydrated lime \_\_\_\_
- 4.3. Type M – Spec. C 270 w/o addition of cements or hydrated lime \_\_\_\_
- 5.1. Masonry cement conform to Table 1 \_\_\_\_
- 6.1. Masonry cement sampled in accordance w/ C 183 \_\_\_\_
- 7.1. Temp & humidity in work area conform to C 109 \_\_\_\_
- 7.2. Moist cabinet or moist room conform to C 511 \_\_\_\_
- 8.1. Determine residue on No. 325 sieve in accordance w/ C 430 \_\_\_\_
- 9.1. Determine normal consistency by Vicat apparatus in accordance w/ C 187 \_\_\_\_
- 10.1. Determine autoclave expansion in accordance w/ C 151 \_\_\_\_  
After molding, store bars in moist cabinet or room 48 hr  $\pm$  30 min., calculate diff. In length before & after autoclaving to 0.01 % of gage length & report as autoclave expansion of masonry cement \_\_\_\_
- 11.1. Determine time of setting by Gillmore needle method in accordance w/ C 266 \_\_\_\_
- 12.1. Determine density of masonry cement in accordance w/ C 188, using kerosene & use in calculation of air content of mortars \_\_\_\_
- 13.1. Balances, sieves, glass graduates, cube molds, tamper, trowel, & testing machine in accordance w/ C 109 \_\_\_\_
- 13.2. Flow table conforming to C 230 \_\_\_\_
- 13.3. Mixing apparatus conforming to C 305 \_\_\_\_
- 13.4. Measure, straightedge, tamper, tapping stick, & spoon conforming to C 185 \_\_\_\_
- 13.5. Specimen cube molds – Molds prepared in accordance to C 109 \_\_\_\_
- 14.1. Sand, blend of = parts by wt. Of graded std sand & std 20 - 30 sand conforming to C 778 \_\_\_\_
- 15.1. Mortar for air entrainment, compr. strngth., & H<sub>2</sub>O retention – 1620 g sand & cement mass to Table 2 \_\_\_\_
- 16.1. Determine mass of 400 ml of mortar in accordance w/ C 185 \_\_\_\_
- 16.2. Calculate air content of mortar according to formula \_\_\_\_
- 17.1.1. Return mortar to mixing bowl, remix 15 sec @ med speed, mold to C 109 \_\_\_\_
- 17.1.2. Store on plane plates in moist environ. 48 to 52 hr, remove from molds, store in moist environ. 5 days, at 7 days, immerse cubes for 28-day tests in lime water in tanks \_\_\_\_
- 17.2.1. Test cubes immediately after removal from moist room or tank & keep moist until test \_\_\_\_
- 17.2.2. Remainder of test procedure conform to C 109 \_\_\_\_
- 18.1. Water-retention shall be determined in accordance w/ C 1506 \_\_\_\_
- 19.1. Store such that easy access to inspection & ID & in weather tight building
- 20.1. Every facility provided to purchaser for inspection & sampling \_\_\_\_
- 20.2. Packages in good condition @ time of inspection \_\_\_\_
- 21.1. Purchaser may reject cement if fails to meet any requirements \_\_\_\_
- 21.2. Purchaser may reject If pckgs. > 2 % below marked mass & whole shipment may be rejected if avg. mass of pckgs. Shown by weighing 50 pckgs. is < that marked on the pckgs. \_\_\_\_
- 21.3. Purchaser may req. retesting on cement stored > 6 mo. & reject if fails to meet any req. of the spec. \_\_\_\_
- 22.1. Purchaser may request mfrs. Certification \_\_\_\_
- 23.1. Brand, name of mfr, type of cement, & net mass in kg shall be marked \_\_\_\_

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COMPRESSIVE STRENGTH OF HYDRAULIC CEMENT MORTARS  
USING 2-IN. OR [50-MM] CUBE SPECIMENS  
ASTM C 109-02

- 5.1. Weight & weighing devices conform to C 1005 \_\_\_\_
- 5.2. Glass graduates of suitable capacities \_\_\_\_
- 5.3. Specimen molds – 2-in. cube molds; interior faces plane & conform to tolerances in Table 1 \_\_\_\_
- 5.4. Mixer, bowl, & paddle – electrically driven mechanical mixer conform to C 305 \_\_\_\_
- 5.5. Flow table & flow mold conform to C 230 \_\_\_\_
- 5.6. Tamper – nonabrasive, nonbrittle rubber mat'l w/ Shore A rdg of  $80 \pm 10$  or seasoned oak,  $\frac{1}{2} \times 1 \times 5$  or 6-in. \_\_\_\_
- 5.7. Trowel – steel blade 4 – 6 in. long \_\_\_\_
- 5.8. Moist cabinet or room conform to C 511 \_\_\_\_
- 5.9. Testing machine w/ accuracy of  $\pm 1.0$  % of indicated load \_\_\_\_  
If dial indicator, dial readable to at least 0.1 % of full scale & readable to w/in 1 % of indicated load \_\_\_\_
- 5.9.1. Digital load indicator numerical increment  $\leq 0.1$  % of full-scale load & accurate to 1.0 % \_\_\_\_
- 5.9.2. Spherical seated upper block & plane to 0.001-in. (0.025-mm) \_\_\_\_
- 6.1. Sand shall be natural silica sand conform to C 778 \_\_\_\_
- 7.1. Temp of air in vicinity, mixing water, moist cabinet or room, and tanks  $73.5 \pm 5.5^\circ\text{F}$  ( $23.0 \pm 3.0^\circ\text{C}$ ) \_\_\_\_
- 7.2. Humidity of lab not  $< 50$  % & moist cabinet or room conform to C 511 \_\_\_\_
- 8.1. Make 3 specs for ea period of test or test age \_\_\_\_
- 9.1. Lubricate mold \_\_\_\_
- 9.2. Seal the surfaces where the halves of mold join \_\_\_\_
- 9.3. Make a watertight seal \_\_\_\_
- 10.1.1 Mix 1 part cement to 2.75 parts graded sand by wt; use water-cement ratio of 1.485 for Portland cements & 0.460 for air-entraining cements \_\_\_\_
- 10.1.2. Quantities for 6 & 9 spec using proper proportions \_\_\_\_
- 10.2.1. Mechanically mix in accordance w/ C 305 \_\_\_\_
- 10.3.1. Determine flow in accordance w/ C 1437 \_\_\_\_
- 10.3.2. Portland & air-entraining cements record flow \_\_\_\_
- 10.3.3. Cements other than 10.3.2, make trial mortars w/ various % of  $\text{H}_2\text{O}$  until correct flow obtained \_\_\_\_
- 10.4.1. Return to mixing bowl, remix 15 sec \_\_\_\_
- 10.4.2. If dup batch skip flow, stand 90 sec, scrape sides last 15 sec, remix 15 sec @ med speed \_\_\_\_
- 10.4.3. Mold not  $> 2 \frac{1}{2}$  min after mix, place mortar 1-in in cube, tamp 32 times ~ 10 sec in 4 rounds, tamp 2<sup>nd</sup> layer same s 1<sup>st</sup> layer and trim \_\_\_\_
- 10.5. Place spec in molds on base plates in moist cabinet or room 20 – 72 hr, if removed from molds before 24 hr, keep in moist environ until 24 hr, immerse except those for 24 hr test in saturated lime water \_\_\_\_
- 10.6.1. Test soon as practicable from moist storage & test according to time table \_\_\_\_
- 10.6.2. Surface-dry specs. & remove loose particles \_\_\_\_  
If more than 1 spec removed, keep moist until test \_\_\_\_
- 10.6.3. Load faces that were in contact w/ true plane surfaces of mold \_\_\_\_  
Load rate of 200 – 400lb/s (900 – 1800 N/s) \_\_\_\_
- 11.1. Calculate compressive strength in psi or MPa \_\_\_\_  
Maximum load / area of loaded surface,  $\text{in}^2$  or  $\text{mm}^2$  \_\_\_\_
- 12.1. Report flow to 1 % & water used to 0.1 %, avg compr strength to nearest 10 psi \_\_\_\_
- 13.1. Do not use specimens that are manifestly faulty \_\_\_\_
- 13.2. Max permissible range between specs from same batch of mortar @ same test age 8.7 % of the avg when 3 cubes represent a test age & 7.6 % when 2 cubes represent a test age (Note 9) \_\_\_\_
- 13.3. If range of 3 specs exceeds max in 13.2, discard result differing most from avg & chk other 2 spec \_\_\_\_  
Make retest of the spl if  $< 2$  specs remain after discarding faulty specs or tests that fail to comply w/ max permissible range of 2 specs \_\_\_\_

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SAMPLING AND TESTING CONCRETE MASONRY UNITS AND RELATED UNITS  
ASTM C 140-02

## 5. Measurement of Dimensions:

## 5.1. Apparatus:

- 5.1.1. Measure overall dim. w/ steel scale w/ not > 0.1-in (2.5-mm) divisions \_\_\_\_  
Face shell & web thickness w/ caliper w/ not > 0.01-in (0.25-mm) divisions & jaws not < 0.5-in (12.7-mm) or > 1-in (25.4-mm) in length \_\_\_\_

- 5.2. Specs – 3 full-size units measured for width, ht, & length, & max thickness of face shells & webs \_\_\_\_

## 5.3. Measurements:

- 5.3.1. Width (W) @ mid-length, ht (H) @ mid-length, & length (L) @ mid-ht \_\_\_\_  
5.3.2. Get face shell thickness ( $t_{fs}$ ) & web thickness ( $t_w$ ) at thinnest pt & avg msrmts \_\_\_\_

## 6. Compressive Strength:

- 6.1. Testing machine w/ accuracy of  $\pm 1.0$  % of indicated load \_\_\_\_

Spherical seated upper block \_\_\_\_

- 6.1.1. Single bearing plate (1/4-in > length & width of units) if upper or lower platen not large enough \_\_\_\_  
6.1.2. Platen & plate plane to 0.001-in. (0.025-mm) \_\_\_\_

## 6.2. Test Specimens:

- 6.2.1. 3 of 6 units tested, store in air @  $75 \pm 15^\circ\text{F}$  ( $24 \pm 8^\circ\text{C}$ ) @ not < 80 % humidity not < 48 hr \_\_\_\_  
Specimens full sized units, except as modified in 6.2.2 – 6.2.5 \_\_\_\_  
6.2.6. Segmental retaining wall units shall be a coupon, have ht to thickness ratio of 2 to 1 before capping, length to thickness ratio of 4 to 1 \_\_\_\_; Saw-cutting, if necessary in accordance w/ 6.2.6.1 & 6.2.7 \_\_\_\_  
6.2.8. Specs that net area can't be obtained by 9.4.1, saw-cut 3 more units to proper dimensions \_\_\_\_

## 6.3. Capping Test Specimens:

- 6.3.1. Cap bearing surfaces by 6.3.2 or 6.3.3 \_\_\_\_  
6.3.2. Sulfur & granular materials – cure minimum 2 hr before use \_\_\_\_  
6.3.3. Gypsum cement capping - cure minimum 2 hr before use \_\_\_\_

## 6.4. Procedure:

- 6.4.1. Align w/ center of upper bearing block \_\_\_\_  
6.4.2. At time of test specs free of visible moisture \_\_\_\_  
6.4.3. Load up to  $\frac{1}{2}$  expected max load @ any rate, then adjust rate to apply remaining load 1 – 2 min \_\_\_\_

## 7. Flexural Load on Concrete Roof Pavers:

- 7.1. Three full-size units shall be tested \_\_\_\_  
7.2. Cap units w/ recesses or irregular surfaces \_\_\_\_  
7.3. Testing arrangement as in Fig 2; uniform rate of loading to get total load in 1 – 3 min \_\_\_\_

## 8. Absorption:

- 8.1. Apparatus – balance sensitive to w/in 0.5 % of wt of smallest spec \_\_\_\_  
8.2. Test Specimens – 3 full-size units properly prepared & recorded \_\_\_\_  
8.3. Procedure:  
8.3.1. Soak in  $\text{H}_2\text{O}$  @  $60 - 80^\circ\text{F}$  ( $15.6 - 26.7^\circ\text{C}$ ) for 24 hr, remove & drain 1 min \_\_\_\_  
8.3.2. Dry in oven @  $212 - 239^\circ\text{F}$  ( $100 - 115^\circ\text{C}$ ) not < 24 hr until 2 weighings change not > 0.2 % \_\_\_\_

## 9. Calculation:

- 9.1. Absorption \_\_\_\_  
9.2. Moisture content \_\_\_\_  
9.3. Density \_\_\_\_  
9.4. Average net area \_\_\_\_  
9.5. Gross area \_\_\_\_  
9.6. Compressive strength \_\_\_\_  
9.7. Equivalent web thickness \_\_\_\_  
9.8. Equivalent thickness \_\_\_\_  
9.9. Ballast weight \_\_\_\_

## 10. Report \_\_\_\_

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AUTOCLAVE EXPANSION OF PORTLAND CEMENT  
ASTM C 151-00

## 4. Apparatus:

- 4.1. Weighing devices & weights in accordance w/ C 1005 \_\_\_\_
- 4.2. Glass graduates (200 or 250-ml) conforming to C 490 \_\_\_\_
- 4.3. Molds, 1 X 1-in (25.4 X 25.4-mm) cross-section conforming to C 490 \_\_\_\_
- 4.4. Flat trowel, straight-edged, 4 – 6-in (100 – 150-mm) long \_\_\_\_
- 4.5. Autoclave, consisting of a high-pressure steam vessel w/ therm well \_\_\_\_  
Automatic pressure control & rupture disk w/ bursting pressure of 350 psi (2.4 Mpa)  $\pm$  5 % \_\_\_\_
- 4.5.1. Rupture disk – made of mat'l w/ tensile strength rel insensitive to temp 68 – 420°F (20 – 216°C) & electrochemically compatible w/ pipe leading to it & its holder \_\_\_\_
- 4.6. Length comparator conforming to C 490 \_\_\_\_

## 5. Temperature &amp; Humidity:

- 5.1. Maintain temp of molding room, dry mat'ls & mixing H<sub>2</sub>O, & rel humidity of room to limits of C 490 \_\_\_\_
- 5.2. Moist storage facilities – maintain temp & humidity of moist storage in accordance w/ C 511 \_\_\_\_

## 7. Number of Test Specimens:

- 7.1. Make at least one test spec \_\_\_\_

## 8. Preparation of Specimen Molds:

- 8.1. Prepare molds in accordance w/ C 490 \_\_\_\_

## 9. Preparation of Test Specimens:

- 9.1. Mixing cement paste – make std batch of 650 g of cement & H<sub>2</sub>O to get normal consistency in accordance w/ C 187 & mix in accordance w/ C 305 \_\_\_\_
- 9.2. Molding specs – immediately after 9.1, mold spec in 2 layers, compacted w/ thumb or forefingers, trim flush w/ top of mold \_\_\_\_
- 9.3. Store specs in moist closet or room 20 hr, if removed before 24 hr, keep in moist closet or room \_\_\_\_

## 10. Procedure:

- 10.1. 24  $\pm$  30 min, remove from moist environment, place in autoclave @ room temp \_\_\_\_  
Autoclave w/ enough H<sub>2</sub>O, @ temp of 68 - 82°F (20 - 28°C) to maintain saturated steam vapor for entire test \_\_\_\_
- 10.2. Early, leave vent valve open until steam begins to escape, close valve & raise temp to bring gage pressure to 295 psi (2 Mpa) in 45 – 75 min, maintain 295  $\pm$  10 psi (2  $\pm$  0.07 Mpa) for 3 hr, cool such that pressure is < 10 psi in 1 ½-hr, vent, place spec in H<sub>2</sub>O @ temp > 194°F (90°C), cool H<sub>2</sub>O around bars so that temp of H<sub>2</sub>O is lowered to 74°F in 15 min, remove 1 spec & obtain length comp rdg \_\_\_\_

## 11. Calculation:

- 11.1. Calculate change in length by subtracting length comp rdg before autoclaving from rdg after, report as % of effective gage length to 0.01 % \_\_\_\_  
Report % of increase in length as autoclave expansion \_\_\_\_  
Indicate a decrease in length by a minus sign prefixed to the % value \_\_\_\_

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AIR CONTENT OF HYDRAULIC CEMENT MORTAR  
ASTM C 185-02

## 5. Apparatus:

- 5.1. Flow table, mold, & caliper conforming to C 230 \_\_\_\_
- 5.2. Measure – cylindrical, inside dia  $76 \pm 2$  mm & depth (~ 88 mm), adjusted by standardization w/ H<sub>2</sub>O to contain  $400 \pm 1$  ml @  $23.0 \pm 2.0^{\circ}\text{C}$  \_\_\_\_
- 5.3. Mixer, bowl, & paddle conforming to C 305 \_\_\_\_
- 5.4. Steel straightedge not < 200 mm long & not < 1.5 mm or < 3.5 mm thick \_\_\_\_
- 5.5. Weights & weighing devices conforming to C 1005 \_\_\_\_
- 5.6. Glass graduates – 250-ml conforming to E 438, & E 694 \_\_\_\_
- 5.7. Tamper conforming to C 109 \_\_\_\_
- 5.8. Tapping stick – hard wood, ~ 16 mm dia & ~ 152 mm long \_\_\_\_
- 5.9. Spoon – not < 230 mm long & w/ bowl ~ 100 mm long \_\_\_\_

## 6. Temperature &amp; Humidity:

- 6.1. Maintain temp of room & dry mat'ls @  $23.0 \pm 2^{\circ}\text{C}$  \_\_\_\_
- 6.2. Condition mixing H<sub>2</sub>O & measure, if it is cal'd  $23.0 \pm 2^{\circ}\text{C}$  \_\_\_\_
- 6.3. Maintain rel humidity of lab @ not < 50 % \_\_\_\_

## 7. Standard Sand:

- 7.1. Sand conforming to C778 for 20 – 30 sand \_\_\_\_

## 8. Sampling:

- 8.1. Spl cement in accordance w/ C 183 \_\_\_\_

## 9. Procedure:

- 9.1. Batch 350 g mortar to 1400 g 20 – 30 sand w/ H<sub>2</sub>O for flow of  $87.5 \pm 7.5$  % in accordance w/ 9.3 \_\_\_\_
- 9.2. Mix mortar in accordance w/ C 305 \_\_\_\_
- 9.3. Place layer of mortar ~ 25 mm thick & tamp 20 X, overfill mold & tamp same as 1<sup>st</sup> layer, trim flush w/ top of mold, lift mold after 1-min & drop table 10 X \_\_\_\_
- 9.4. When H<sub>2</sub>O has flow of  $87.5 \pm 7.5$  %, get mass of 400 ml of mortar, place in 400-ml measure in 3 layers tamp 20 X, complete w/in 1.5 min, get mass of measure & contents & get mass of mortar \_\_\_\_

## 10. Calculations \_\_\_\_

## 11. Report:

- 11.1. When used for specific action in compliance testing, report air content to 1 % \_\_\_\_

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NORMAL CONSISTENCY OF HYDRAULIC CEMENT  
ASTM C 187-98

## 4. Apparatus:

- 4.1. Weights & weighing devices in accordance w/ C 1005 \_\_\_\_
- 4.2. Glass graduates (200 – 250-ml) conforming to C 490 \_\_\_\_
- 4.3. Vicat apparatus as in Fig 1 \_\_\_\_

## 5. Temperature &amp; Humidity:

- 5.1. Temp of air in work area & equipment 20 – 27.5°C (68 – 81.5°F) \_\_\_\_  
Temp of mixing H<sub>2</sub>O 23.0 ± 2.0°C (73.5 ± 3.5°F) \_\_\_\_
- 5.2. Rel Humidity of lab not < 50 % \_\_\_\_

## 6. Procedure:

- 6.1. Mix 650 g cement w/ measure amt H<sub>2</sub>O using Procedure for Mixing Pastes in C 305 \_\_\_\_  
H<sub>2</sub>O conform to num limits in D 1193 for Type III or IV grade of reagent H<sub>2</sub>O \_\_\_\_
- 6.2. Form paste into ball w/ gloved hands \_\_\_\_  
toss 6 X thru free path of ~ 150 mm (6 in) from 1 hand to another to get nearly spherical mass \_\_\_\_  
Press ball into larger end of conical ring, remove excess @ larger end, place ring on larger end on base plate & slice off excess \_\_\_\_
- 6.3. Center paste under rod B, plunger end brought in contact w/ paste, tighten set-screw \_\_\_\_  
Set movable indicator to upper 0 mark or take initial rdg, release rod not > 30 sec after mixing \_\_\_\_  
Paste normal consistency when rod settles 10 ± 1 mm below orig surface in 30 sec after release

\_\_\_\_ Use trial pastes w. varying % of H<sub>2</sub>O \_\_\_\_

## 7. Calculation:

- 7.1. Calculate amt of H<sub>2</sub>O req'd for normal consistency to 0.1 % & report to 0.5 % of wt of dry cement  
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TIME OF SETTING OF HYDRAULIC-CEMENT PASTE BY GILLMORE NEEDLES  
ASTM C 266-99

## 5. Apparatus:

- 5.1. Trowel w/ steel blade 100 – 150 mm ( 4 – 6 in) long \_\_\_\_
- 5.2. Mixer, bowl, paddle, & scraper conforming to C 305 \_\_\_\_
- 5.3. Glass graduates conforming to C 490 \_\_\_\_
- 5.4. Mass determining devices conforming to C 1005 \_\_\_\_
- 5.5. Plane non-absorptive plates (102 ± 3 mm (4 ± 0.125 in) square \_\_\_\_
- 5.6. Gillmore needles conforming to the following \_\_\_\_
  - 5.6.1. Initial setting-time needle 113.4 ± 0.5 g (0.250 ± 0.001 lb) \_\_\_\_  
Tip dia 2.12 ± 0.05 mm (0.84 ± 0.002 in) \_\_\_\_
  - 5.6.2. Final setting-time needle 453.6 ± 0.5 g (1.000 ± 0.001 lb) \_\_\_\_  
Tip dia 1.06 ± 0.05 mm (0.042 ± 0.002 in) \_\_\_\_
  - 5.6.3. Needle tips cylindrical for distance of 4.8 ± 0.5 mm (0.189 ± 0.020 in) \_\_\_\_  
Needle ends plane & @ rt angles to axis of rod \_\_\_\_

## 6. Reagents:

- 6.1. Potable H<sub>2</sub>O for routine tests \_\_\_\_  
Referee & cooperative tests, reagent H<sub>2</sub>O conforming to D 1193 for Type III or IV \_\_\_\_

## 7. Sampling:

- 7.1. For acceptance testing, spl cement in accordance w/ C 183 \_\_\_\_

## 8. Conditioning:

- 8.1. Temp of room & equipment 20 – 27.5°C (68 – 81.5°F) \_\_\_\_  
Temp of mixing H<sub>2</sub>O 23.0 ± 2.0°C (73.5 ± 3.5°F) \_\_\_\_
- 8.2. Rel Humidity of lab not < 50 % \_\_\_\_
- 8.3. Moist cabinet or room conform to C 511 \_\_\_\_

## 9. Procedure:

- 9.1.1. Mix 650 g cement w/ H<sub>2</sub>O for normal consistency in accordance w/ C 305 \_\_\_\_
- 9.1.2. Time of setting & autoclave expansion spec (C 151) may be made from same batch \_\_\_\_
- 9.1.3. Time of setting or autoclave expansion spec (C 151) may be made from rest of batch \_\_\_\_
- 9.2. Make pat w/ flat top & side taper to thin edge \_\_\_\_  
Place in moist cabinet or room to remain except when time of setting performed \_\_\_\_
- 9.3. Hold needles vert & apply lightly to surface of pat \_\_\_\_  
Initial set achieved when pat will bear, w/o appreciable indentation, initial Gillmore needle \_\_\_\_  
Diff in min from time of contact of cement & H<sub>2</sub>O & time paste gets initial set is initial setting time \_\_\_\_  
Final set achieved when pat will bear, w/o appreciable indentation, final Gillmore needle \_\_\_\_  
Diff in min from time of contact of cement & H<sub>2</sub>O & time paste gets final set is final setting time \_\_\_\_

## 10. Report:

- 10.1. Initial Time of Setting, Gillmore, min  
Final Time of Setting, Gillmore, min

Data Sheet \_\_\_\_



S\_\_\_F\_\_\_

MECHANICAL MIXING OF HYDRAULIC CEMENT PASTES AND  
MORTARS OF PLASTIC CONSISTENCY  
ASTM C 305-99

## 4. Apparatus:

- 4.1. Mixer – electrically driven mechanical of epicyclic type \_\_\_\_
- 4.2. Paddle – removable stainless steel as in Fig 2 \_\_\_\_
- 4.3. Mixing bowl w/ 4.73 L capacity \_\_\_\_
- 4.4. Scraper – semi rigid rubber \_\_\_\_
- 4.5. Supplementary apparatus – balances, wts, glass graduates, & other apparatus needed \_\_\_\_

## 5. Temperature &amp; Humidity:

- 5.1. Temp of room & equipment, 20 – 27.5°C (68 – 81.5°F) \_\_\_\_  
Temp of mixing H<sub>2</sub>O, 23 ± 1.7°C (73.4 ± 3°F) \_\_\_\_
- 5.2. Humidity – not < 50 % \_\_\_\_

## 6. Materials, Proportioning, &amp; Consistency:

- 6.1. Mat's, proportions, & quantity conform to requirements in particular method for preparation \_\_\_\_

## 7. Procedure for Mixing Pastes:

- 7.1. Put dry paddle & dry mixing bowl in mixing position in mixer, add batch mat'ls \_\_\_\_
  - 7.1.1. Place all mixing H<sub>2</sub>O in bowl \_\_\_\_
  - 7.1.2. Add cement to H<sub>2</sub>O, allow 30 sec for absorption \_\_\_\_
  - 7.1.3. Mix @ 140 ± 5 RPM for 30 sec \_\_\_\_
  - 7.1.4. Stop for 15 sec, scrape paste off sides \_\_\_\_
  - 7.1.5. Mix @ 285 ± 10 RPM for 1 min \_\_\_\_

## 8. Procedure for Mixing Mortars:

- 8.1. Put dry paddle & dry mixing bowl in mixing position in mixer, add batch mat'ls \_\_\_\_
  - 8.1.1. Place all mixing H<sub>2</sub>O in bowl \_\_\_\_
  - 8.1.2. Add cement to H<sub>2</sub>O & mix @ 140 ± 5 RPM for 30 sec \_\_\_\_
  - 8.1.3. Add all sand slowly for 30 sec while mixing \_\_\_\_
  - 8.1.4. Stop mixer, change to 285 ± 10 RPM, & mix for 30 sec \_\_\_\_
  - 8.1.5. Stop mixer, stand for 1.5 min \_\_\_\_  
First 15 sec scrape mortar off sides, rest of 1.5 min cover bowl w/ lid \_\_\_\_
  - 8.1.6. Mix @ 285 ± 10 RPM for 1 min \_\_\_\_

Data Sheet \_\_\_\_

S\_\_\_F\_\_\_

PRECONSTRUCTION AND CONSTRUCTION EVALUATION OF MORTARS FOR  
PLAIN REINFORCED UNIT MASONRY  
ASTM C 780-02

## 7. Apparatus:

7.1. Apparatus listed in the individual tests included in the annexes \_\_\_\_

## 9. Sampling:

9.1. This section deals with sampling in lab &amp; @ jobsite:

9.2.1. Bagged mat'l be type &amp; brand used or considered for actual construction \_\_\_\_

9.2.2. Aggregate from same source &amp; same description as used or considered for actual construction \_\_\_\_

9.2.3. Water not need to be same as construction, except water that has properties that affect testing \_\_\_\_

9.3. Get spls from lab &amp; construction site &amp; mix together \_\_\_\_

9.3.1. Batch mixer spls from discharge or after discharged into receptacle \_\_\_\_

9.3.2. Take mortar for mortar boards as in 9.3.1 &amp; place on typical mortar boards used @ job site \_\_\_\_

9.3.3. Take retempered mortar board spls from mason's mortar board after mixing &amp; retempering \_\_\_\_

9.4. Record date, time, place, &amp; method of sampling \_\_\_\_

## 10. Test Specimens:

10.1. Measure mortar properties during preconstruction evaluation on single spec \_\_\_\_

10.2. Measure mortar properties during construction evaluation on single spec \_\_\_\_

10.3. Actual constr eval, &amp; for batch-to-batch variations, spl 3 batches for plastic &amp; hardened properties \_\_\_\_

## 11. Procedure:

11.1. Mechanically prepare &amp; mix mortar for preconstr eval w/mat'ls &amp; proportions for constr \_\_\_\_

11.1.1. Use sand damp, as-received, correct H<sub>2</sub>O added as free water above SSD condition \_\_\_\_

11.1.2. Prebatch by wt, to desired volume proportions \_\_\_\_

11.1.3. Mix to the following:

11.1.3.1. If 2<sup>+</sup> cementitious mat'ls for preconstr eval, pre-blend \_\_\_\_

11.1.3.2. Charge mixer for preconstr eval as follows:

(1) ~ ½ estimated H<sub>2</sub>O \_\_\_\_

(2) Sand \_\_\_\_

(3) Cementitious mat'l \_\_\_\_

(4) Balance of mixing H<sub>2</sub>O \_\_\_\_11.1.3.3. Mix mortar for preconstr eval @ normal speed 5 min, H<sub>2</sub>O additions made during 1<sup>st</sup> 4 min \_\_\_\_

11.1.3.4. Determine cone penetration for preconstr eval in accordance w/ Annex A1 \_\_\_\_

## 12. Report:

12.1.1. Test results &amp; all pertinent data \_\_\_\_

## Annexes:

A1. Consistency by Cone Penetration Test Method \_\_\_\_

A2. Consistency Retention of Mortars for Unit Masonry \_\_\_\_

A3. Initial Consistency &amp; Consistency Retention or Board Life of Masonry Mortars using a Modified Concrete Penetrometer \_\_\_\_

A4. Mortar Aggregate Ratio Test Method \_\_\_\_

A5. Mortar Water Content Test Method \_\_\_\_

A6. Mortar Air Content Test Method \_\_\_\_

A7. Compressive Strength of Molded Masonry Mortar Cylinders &amp; Cubes \_\_\_\_

A8. Splitting Tensile Strength of Molded Masonry Mortar Cylinders \_\_\_\_

A9. Preconstruction &amp; Construction Evaluation of Mortars for Unit &amp; Reinforced Masonry \_\_\_\_

Data Sheet \_\_\_\_

S\_\_\_\_F\_\_\_\_

SAMPLING AND TESTING GROUT  
ASTM C 1019-03

## 4. Apparatus:

- 4.1. Max-min thermometer \_\_\_\_
- 4.2. Steel straightedge not < 6-in long & not < 1/16-in thick \_\_\_\_
- 4.3. Tamping rod – nonabsorbent, nominally 5/8-in w/ hemispherical tip, not < 12-in long \_\_\_\_
- 4.4. Nonabsorbent blocks – rigid square, side dimension = ½ desired spec ht Figs 1 & 2 \_\_\_\_
- 4.5. Panels & plates – pieces of ¾-in. plywood or equivalent, coated to make impermeable \_\_\_\_

## 5. Test Specimens:

- 5.1. Spec sq. cross-section  $\geq$  3-in (76-mm) on sides, ht. 2 X width \_\_\_\_
- 5.2.  $\geq$  3 spec @ ea age \_\_\_\_

## 6. Mold Construction:

- 6.1. Select level vibration free location for molds to remain undisturbed 48 hr \_\_\_\_
- 6.2. Construction of mold simulate in-situ constr \_\_\_\_
- 6.3. Form space w/ sq cross-section  $\geq$  3-in high, ht 2 X width \_\_\_\_  
Surface of unit in contact w/ grout shall not previously be used \_\_\_\_  
Space tolerance & spec dimensions w/in 5 % of width (Figs 1 & 2, & notes) \_\_\_\_
- 6.4. Line surfaces w/ thin, permeable mat'l \_\_\_\_
- 6.5. Brace units to prevent displacement \_\_\_\_

## 7. Sampling Grout:

- 7.1. Spls for slump & compr strength minimum ½ ft<sup>3</sup> (0.014 m<sup>3</sup>) \_\_\_\_
- 7.2. Use appropriate precautions that allow representative sampling; after final slump adjustment, spl as grout being placed \_\_\_\_
  - 7.2.1. Field sampling - get 2<sup>+</sup> portions from middle portion of batch \_\_\_\_
  - 7.2.2. Lab sampling – use entire batch of grout \_\_\_\_
- 7.3. Transport spl to mold location, protect from sun, wind, rapid evaporation \_\_\_\_

## 8. Temperature &amp; Slump Test:

- 8.1. Measure & record temp in accordance w/ C 1064 \_\_\_\_
- 8.2. Start slump w/in 5 min \_\_\_\_
- 8.3. Measure & record slump in accordance w/ C 143 \_\_\_\_

## 9. Compressive Test Specimen:

- 9.1. If spl from slump, remix, start filling mold w/in 15 min \_\_\_\_
- 9.2. Fill in 2 layers, rod ea. layer 15 times, ½ in. penetration, overfill mold \_\_\_\_
- 9.3. Strike off w/ straightedge \_\_\_\_
- 9.4. W/in 30 min. add grout to fill void caused by initial H<sub>2</sub>O loss, strike off w/ straightedge, cover \_\_\_\_
- 9.5. Protect from freezing & variations in temp, store max-min therm, record temps prior to final cure \_\_\_\_

## 10. Transportation, Curing, &amp; Testing of the Specimens:

- 10.1. Remove molds 24 – 48 hr after making specs \_\_\_\_
- 10.2. W/in 30 min of mold removal, place in protective container & keep damp \_\_\_\_
- 10.3. Transport to lab w/in 8 hr after mold removal \_\_\_\_
- 10.4. W/in 8 hr after mold removal, store in moist room, moist cabinet, or water storage tank conforming to C 511 until day of testing \_\_\_\_
- 10.6. Cap in accordance w/ C 617 \_\_\_\_
- 10.7. Measure & record width of ea. face @ mid-ht., ht @ mid-ht., & amt out of plumb @ mid-width \_\_\_\_
- 10.8. Test in damp condition in accordance w/ C 39 \_\_\_\_

## 11. Calculations:

- 11.4. Determine avg. cross-sectional area \_\_\_\_
- 11.5. Calculate compr strength to nearest 10 psi \_\_\_\_

## 12. Report \_\_\_\_

Data Sheet \_\_\_\_